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THE
AGRICULTURAL LEDGER.

1895—No. 3.

CROPS.

DICTIONARY OF ECONOMIC PRODUCTS, Vol. II., C. 2089.

CROPS AND CLIMATIC CONDITIONS:

I *Note on some General Observations on the relation of Indian Crops to Climatic
Conditions*—by THE EDITOR.



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The objects of THE AGRICULTURAL LEDGER are :—

- (1) To provide information connected with agriculture or economic products in a form which will admit of its ready transfer to ledgers ;
- (2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept ;
- (3) To admit of the circulation, in convenient form, of information on any subject connected with agriculture or economic products to officials or other persons interested therein ;
- (4) To secure a connection between all papers of interest published on subjects relating to economic products and the official Dictionary of Economic Products. With this object the information published in these Ledgers will uniformly be given under the name and number of the Dictionary article which they more especially amplify. When the subject dealt with has not been taken up in the Dictionary, the position it very possibly would occupy in future issues of that work will be assigned to it.

E. C. BUCK,
Secretary to the Government of India

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CROPS AND CLIMATIC CONDITIONS:

A Note on some General Observations on the relation of Indian Crops to Climatic Conditions—by THE EDITOR.

It has often been felt in the Office of Reporter on Economic Products that we very much require to establish a system of recording observations on the relation of crops to climatic conditions. The information at present available is of the most meagre character. For example, I have spent some days in reading through the articles given in the Dictionary, on the more important crops, in order to see if I could furnish from these a table of the dates of sowing and reaping. I have failed. Fearing this might have been an omission, I have reconsulted the Gazetteers and other provincial publications, from which the Dictionary was compiled, but again I have been unsuccessful. In the case of one or two crops I can find these dates, for more than half the provinces, but in the majority of cases I can only speak with any degree of certainty regarding one or at most two provinces. Such general terms as "sown at the beginning of the rains" are frequent, without its being stated what month that corresponds with, and in a like manner the remarks—a *Rabi* (Spring) or a *Kharif* (Autumn) crop, appear to be intended by the local authors as fully meeting all possible requirements of this nature. The uselessness of such terms can at once be shown by reference to any one province, thus, for example, in the Panjab—Wheat, Gram, *Tur*, Peas, Mustard, Linseed, are Spring crops, but the range of the sowings and reapings of these are :—sown from June to December and reaped from February to April. It is obvious, therefore, that the term "Spring" (*Rabi*) by itself cannot be accepted as of any value.

Speaking generally, it may be said that rainfall has, in this country, a more potent influence than temperature. Extremes of heat and cold may be the controlling factors very possibly in the natural distribution of most wild perennial plants, but with annual crops rainfall or a supply of water artificially is a *sine quâ non*.

Meagre
character
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information.

Rainfall more
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CROPS.	On the relation of Indian Crops
Diversity of crops.	<p>Hence it follows that the expansion of the area of cultivation and the increase of production in cultivated tracts is more dependent on measures of irrigation than anything else. The range of temperature, from summer to winter, and the distribution of land into vast plains, extensive tablelands and lofty highlands, allows of a diversity of cultivation possessed by few other countries in the world. To suit this wide climatic range the cultivator fortunately possesses an extensive series of crops. And further, though ignorant of the principle involved, he has produced by selection special races of certain crops that are direct adaptations to existing conditions. Hence we have in India both Spring and Autumn forms of rice, wheat, <i>jowar</i>, castor-oil, <i>tur</i>, sugar-cane and cotton. The one series of races may be grown on geographically temperate areas, or on tracts which during the Winter months are temperate, while the other may be raised over tropical tracts or during the Summer months. Botanically, these races are often quite indistinguishable, though their recognition is to the cultivator a matter of supreme importance. As a result of these considerations we have the startling state of affairs that a journey from one extreme of India to the other may reveal the cultivators engaged in every stage of the operations connected with certain crops, such as preparing the soil, sowing, watering the advanced crop, reaping, thrashing, and carrying the produce to the market. For example, were the journey made in June from the Panjab to South India, the cultivators would in the north be found engaged in the early preparation of the land, for the crop to be sown in September to December; in mid journey they would be seen tending the mature <i>kable</i> wheat of the Konkan; and in Mysore and some parts of Madras Presidency they would be found sowing wheat—a crop that will be harvested in September, and thus practically at the time that the great wheat crop of Northern India is being only sown. Numerous such examples might be given of the varying climatic conditions that prevail at any one time in this vast Continent and of the direct adaptation of crops within restricted portions of it, to seasonal changes. It may, perhaps, suffice, however, to mention one other example, namely, that of <i>jowar</i> (<i>Sorghum vulgare</i>) which in India is after rice the most important single article of food. In Madras it is sown in January and very nearly right through the year to November, so that there are harvests of this grain every three or four months after sowing, the chief being January-February, April-May, June-July, and August-September. In Hyderabad it is sown in June and July and again in September to November with the harvests four months later. In Bombay the sowings are in June, July, August, September and October with accordingly both Spring and Autumn harvests. But on turning from Southern and Western India (the regions that may be said to have the strongest oceanic climates) the plant becomes an Autumn crop, the sowings being in June, July and August, and the harvest in October to January. It is thus significant that the production of Spring crops of <i>Sorghum</i>—a plant which otherwise ripens in the Autumn—should correspond to the area of Autumn wheats, a cereal which in other parts of India ripens its crop in the Spring. The explanation in both cases is doubtless the same, namely, the great uniformity of temperature, dampness of the air and more or less frequency of rain in</p>
Diversity of conditions.	

to Climatic Conditions. (G. Wath.)

CROPS.

Autumn and Winter as compared with the more interior and northern tracts of India where there is but one season of rainfall. The exact relation of meteorological observations to the conditions of the crops is, however, a subject upon which I find myself unable at present to express any very definite opinion. It has often been pointed out that a line drawn from about Bombay round the southern extremity of the Central Provinces to Patna in Bebar, would divide India into two sections which agriculturally are very different. In the upper section the Winter months are cold and remarkably like the Summer months of Europe. The lower is, on the other hand, perennially tropical, or at most warm-temperate. Moreover, the range of humidity within these two divisions is very dissimilar; in the north large tracts of country exist during Summer as arid, sandy deserts; while to the south the monsoon rains convert many thousands of square miles of country into inland seas. The agricultural systems within the areas of these extremes (where agriculture is at all possible) must be essentially different from each other, and, speaking in general terms, it may be said that the intermediate zone is the chief source of pulses and millers. The northern extremity is the wheat field of India and the south-eastern the rice inundations. Figuratively speaking, the country is as it were tilted on one side west and south from the belt of land that may be spoken of as connecting the arid and the humid extremes. This connecting belt—which corresponds to a large slice of the Gangetic and Indus basins—has well marked Spring and Autumn crops or sub-temperate winter-grown plants of one class and tropical plants raised in Summer and reaped in Autumn, that are botanically not tropical races of the Spring stock, but constitute an entirely distinct series. The vast tableland and the rich uplands and plains to the south and west have, as already explained, a complete blending of forms to suit the varying climatic conditions, but many of these are all more or less related to each other. There is no sharp isolation botanically between the Spring and Autumn crops, and the most noteworthy staple of this region is cotton. In Bombay it may be said wheat decreases in merit from the Panjab frontier toward the sea-coast in the inverse ratio to the improvement in cotton. In South India cotton decreases in merit, wheat practically disappears, and the swampy types of Bengal vegetation re-appear, more especially in the coast districts. Maps of India, if shaded by colours to show percentage of wheat and of rice cultivation to total cultivation, would manifest for wheat a deepening of colour on passing inland owing to the darkest shades having to be given in the Panjab—the most remote area from marine influence or from rain inundation. With rice, on the other hand, the shading would be in the reverse order, deepest as a fringe around the coast and becoming fainter and fainter on passing up the Gangetic basin towards the wheat areas.

The evolution on the one hand of tropical and temperate races of a plant to meet the seasonal changes of certain portions of India, and on the other hand, the selection of entirely distinct summer and winter crops for other tracts, is one of the most striking peculiarities of Indian Agriculture. The best known parallel case in European Agriculture is the existence of Spring and Winter wheats.

The arid and the humid zones.

Selection of crops to suit climate.

The Agricultural

CROPS.	On the relation of Indian Crops
Rains all important.	<p>But it would seem as if the explanation of this multiplicity of races lies in the peculiar influence of the humidity and rainfall (a condition scarcely experienced in Europe) far rather than in the changes of temperature which are characteristic of the regions in question. The hot season of the tropical portions of India acts the part of the Winter of temperate regions. Herbaceous plants wither and disappear, trees and shrubs shed their leaves and in most cases the spring-like bursting of fresh foliage is the first precursor of the approach of the rains. No better example of the all-importance of the rains as the governing factor in Indian Agriculture could possibly be mentioned than that of rice, the swamp crop of the warm tropical regions. There are not only two main crops that correspond as near as may be to the Spring and Autumn crops of Upper India, but several intermediate crops and even certain rice that from sowing to reaping occupy the soil for only sixty days, while other forms require fully three times that period. From the perplexing gradation of forms characteristic of the swamps the adaptation of rice to altered circumstances may be traced through the uplands of the Central Provinces, and the North-West Provinces, and even to the light, sandy wheat fields of the Panjab until, turning up the hills to temperate climes, we are confronted with rice that are grown on dry soils and require no direct inundation. But it may fairly be said that diminution in rainfall and not decrease of temperature has been the restricting influence in the natural multiplication of the forms of rice. It has been estimated that Bengal alone possesses as many as 10,000 recognizable forms of rice. While rice is grown in nearly every province of India, the number of forms or races of that crop met with in any one district, rapidly decreases on leaving the areas of inundation or of great humidity, so that in the dry cultivation of the wheat areas it is probable there are not half a dozen forms of rice. But what is even more striking still may be here added, by way of concluding these remarks, <i>viz.</i>, that in dry areas no crop manifests a strong tendency to multiplication of forms. The well recognizable crops of wheat that are grown in the Panjab might be embraced by, perhaps, not more than a dozen vernacular names. It is much the same with barley, mustard, linseed, safflower, etc. A striking change takes place with the pulse and millet areas, and this culminates, further to the south and east, in the bewildering multiplicity met with in the humid and often inundated tracts of the tropics.</p>
Forms of rice.	<p>While one may thus mention many examples of the striking effects of climate on the nature and character of Indian Agriculture, it is by no means so easy to furnish direct statistical returns nor to frame special tables that might be used in future to record such information. To say that a crop is sown and reaped between certain periods would naturally be very misleading, if applied arbitrarily. The provinces of India even, when dealt with separately, are far too large for any such generalizations. Thus, for example, in Madras there are two seasons of sowing and reaping that are directly governed by the monsoons. Throughout most of the Presidency the rainy season is produced by the north-east monsoon which breaks towards the end of September. Seed is accordingly</p>
Generalisation on climate and crops not possible.	

to Climatic Conditions. (G. Watt.)

CROPS.

sown in October, and the crops harvested in February. But in some districts the crops are raised under the influence of the south-west monsoon, the sowings being made in April and May, and the harvest in August and September. Madras may be said to lie between 8° and 20° north latitude, so that it is entirely within the tropical zone. Yet it has been referred to three great sections (a) the dry region, (b) the moist region, and (c) the very moist region. The first has a rainfall of under 30 inches, and embraces portions of Kistna district, the northern division of Nellore, a large section of Kurnool, nearly the whole of Cuddapah, all Bellary and Anantapur, parts of Salem and Trichinopoly, most of Coimbatore and the eastern portions of Madura and Tinnevely. Over this area rain falls during both monsoons, but only as occasional showers. As showing the approximation of this portion of Madras to that of the dry tracts of India that have a temperate winter, it may be said that it is within these districts that wheat is grown in the Madras Presidency. The moist region of Madras has a rainfall of over 30 inches, but the summer monsoons are very light and the major portion of the rain falls in October and November. This division embraces the whole eastern coast from Ganjam in the north to Madura. It also includes the whole of the Northern Circars, portions of Kistna, Cuddapah, and Kurnool districts, most of Nellore, Chengalput, North and South Arcot, Tanjore, and parts of Salem and the eastern slopes of the Nilghiris, Trichinopoly, and Madura. And lastly the very moist tracts of Madras may be said to be the whole of the West Coast from South Kanara to near Cape Comorin as well as the western slopes of the Ghâts. Below the Ghâts the rainfall varies from 110 to 130 inches and on the Ghâts 150 to 200 inches.

It would thus be obviously misleading to give an average of the sowing times of any one crop for the whole of the Madras Presidency. There is very possibly as great a range of variation within the three regions indicated as between Madras and Bombay or even the Panjab. To arrive at a satisfactory knowledge of the subject, each province should be referred to as many sections as there are well marked areas of rainfall and humidity. Hence I have contended above that a classification based on temperature would be of far less moment than one on humidity and rainfall. Were the Meteorological Department, therefore, to furnish this office with some such classification for all India as I have indicated in the case of Madras, it might be possible to collect the further information required. But in the absence of a classification of the areas of humidity, and in our present state of ignorance regarding the dates of sowing and reaping of crops, the utmost that can be done here is to furnish such particulars as are procurable from Gazetteers and other similar works. These particulars may be thrown into the following table, which it is believed may be found useful, though its absolute accuracy is not vouched for:—

Rainfall more
important
than temper-
ature.

CROPS.

On the relation of Indian Crops

Statement showing the approximate Seasons of Sowing and Reaping

CROP.	PANJAB.		BOMBAY.	
	Sown.	Harvested.	Sown.	Harvested.
CEREALS.	1. Wheat	10-12 4-5R	1-2 6-7K 9-11 2-4R	2-3R
	2. Barley	10-12 3-4R	10-11	
	3. Indian Corn (Zea Mays)	6-9 9-11K	6	8-9K
	4. Jowar (Sorghum vulgare)	7-8 9-12K	6	10-11K
	5. Bajra (Pennisetum typholodeum)	7-8 9-11K	8-10 2-3K	9-10K
	6. Rice	7-8 11K	6	10-11K
PULSES.	7. Gram or Chick pea (Cicer arletinum)	8-10 3-4R	9-10	2-3R
	8. Dal or Thur (Cajanus indicus)	6 3R	6-7	9-2R
	9. Mung or green gram (Phaseolus Mungo)	8 11-12K	5-6	8-9K
	10. Urad or black gram (Phaseolus Mungo var. radiatus)	8 11-12K	6	9K
	11. Moth (Phaseolus aconitifolius)	7-8 11K	6-7	10-11K
	12. Shim or Poput (Dolichos Lablab)	7-8 11K	6-7	10-11K
	13. Kulthi or Horse gram (Dolichos biflorus)	7-8 11K	6-9	10-11K
	14. Peas	9-10 4R	10-11	2-3R
	15. Mustard	8-9 2-3R	Nil	Nil
	16. Rape	8-11 3-4R	10-11	2-3R
OIL-SEEDS.	17. Linseed	9-10 3-4R	11	2R
	18. Til (Sesamum Indicum)	7-8 11K	6-7	9-11K
	19. Castor (Ricinus communis)	6-11 K11-2R	6-10	K11-2R
	20. Ground-nut (Arachis hypogaea)	Nil Nil	6	12
	21. Cotton	4-5 K9-1R	6-7	K11-12-3R
	22. Jute	Not much cultivated		has been tried
FIBRES.	23. Sunn-hemp (Crotalaria juncea)	7 10-11K	7	10
	24. Indigo	4-5 8-9		Being opened up.
	25. Safflower (Carthamus tinctorius)	Little grown, 2 10K	10-11 1-3	2-3R 12-2K
	26. Sugar-cane	3 12-2R	6	5R

Note.—The letters R and K denote Rabi (Spring) and Kharif

to Climatic Conditions. (G. Watt.)								CROPS.
the Principal Crops in the six chief Provinces of India.								
CENTRAL PROVINCES.		NORTH-WEST PROVINCES AND OUDH.		BENGAL.		MADRAS.		
Sown.	Harvested.	Sown.	Harvested.	Sown.	Harvested.	Sown.	Harvested.	
10-11	3-4R	5-10	3-5R	10-11	3-4R	5-6	9-10	1 Wheat.
10-11	2-3R	9-10	3-4R	10-11	3-4R	...	...	2 Barley.
6-7	10K	6-7	8-9K	7	9K	3-4	6-7K	3 Indian Corn.
6-7	11-12K	6-7	11-12K	6	9-10K	5-7	8-9-10K	4 Jowar.
8	10K	7-8	10-11K	Little grown.		10-11	1-2R	5 Bajra.
6	10-11K	2-3	8-9	5-6	7-8K	1-2	5-6K	6 Rice.
10-11	3R	9-10	3-5R	12-2	5-6K	10-11	1-2R	7 Gram.
6	2-3R	6-7	10-4R	10-11	9-10K	11-12	2-3-4R	8 Dal.
6-7	10K	6-7	10K	9-10	12-1R	...	...	9 Mung.
6-7	10K	7-8	11-12K	...	...	8-9	12-1R	10 Urad.
7-8	11K	7-8	11-12K	8	12-1R	...	...	11 Moth.
7-8	11K	7-8	11-12K	8	11-1R	7-8	2-3R	12 Shim.
6-8	11K	7-8	11-12K	8	11-12K	6-8	10-12K	13 Kulthi.
9	3R	10	2-3R	10-11	2-3R	8-11	3R	14 Peas.
8	3R	9-10	12-1R	11-12	1-2R	8-10	12-2R	15 Mustard.
8-9	3-4R	10-11	4-5R	10	3-4R	...	...	16 Rape.
9	3-4R	10	4-5R	10	3-4R	...	...	17 Linseed.
7-8	10-11K	6-7	10-11K	2-3	0-7K	4-5	7-8-9K	18 Til.
7	12-2R	6-7	2-3R	6-7	11-12K	1-2	5-6K	19 Castor.
Nil	Nil	Nil	Nil	8-9	3R	7-8	...	20 Ground-nut.
6	10K	7	2R	10	6K	...	...	21 Cotton.
7	10K	6	10K	4-7	9-1K	7-8-9	3-6R	22 Jute.
in the Central Provinces.		6	10K	9-12	2-7R	10-11-1	1-8	23 Sunn hemp.
Nil	Nil	4-5	8-9K	1-2	8-9K	Nil	Nil	24 Indigo.
Little grown.		9	2-4R	3-6	6-10K	1-2	6-7-8K	25 Safflower.
1-2	12K	3-4	12-3R	6-7	8-9	7-8	10-1-2	26 Sugar-cane.
				10-12-1	2-3-5R	...	...
				1-2-3	12-1-2	1-3-6	12-2-4	
				4-5-6	1-2-3R			

(Autumn) crops; the figures are the months of the year.

CROPS.	On the relation of Indian Crops, etc.
Time for sowing and reaping.	<p>The value of even an approximate statement of the average dates of sowing and reaping the crops of an entire province is open to as many errors as would be any statement of mean temperature or rainfall. There is no province in India that does not possess extensive variations in climate, soil and nature of products. Little more therefore can be done at present than to express personal opinions, until the areas of India are grouped upon some scientific principle, and the data thereafter furnished that would justify conclusions being drawn as to the influences of climatic conditions on the production and preservation of the meritorious properties of crops. The efforts that have been put forth in this country at acclimatization of foreign plants may (in the absence of the knowledge here indicated) be fairly correctly characterised as haphazard experiments and speculations. Various attempts have been made by botanists to establish the assemblages of wild plants that are characteristic of certain Indian areas, but in dealing with the cultivated plants it would seem to me safer to work back from existing climatic phenomena than to reverse the order of things by seeking for climatologic explanations of the present crops. The chief points that we require to know are :—</p>
Information wanted.	<ul style="list-style-type: none"> (a) period of maximum rainfall in tracts of country isolated from the surrounding districts through that peculiarity ; (b) period of greatest humidity in association with maximum temperature over fixed regions ; and (c) the opposite conditions, namely, minimum rainfall and humidity in association with maximum and minimum temperature. Average temperatures and average humidities are practically of no value in regulating the distribution of plants. But the duration of a medium humidity or medium temperature is of vital importance. An abnormally high rainfall confined to a restricted period might have a destructive effect on the possible existence of certain wild vegetable forms, while the same amount of rain diffused over a much longer period would allow of the growth of an altogether different series of crops ; in fact, make the difference between a garden triumph of laborious cultivation and a commercial production. <p style="text-align: right;">GEORGE WATT.</p> <p style="text-align: right;">12th March 1895.</p>

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series. Those on Forestry, in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

This sheet and the title-page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page.